IPSWICH ELEMENTARY SCHOOL

MEP & SUSTAINABILITY WORKSHOP

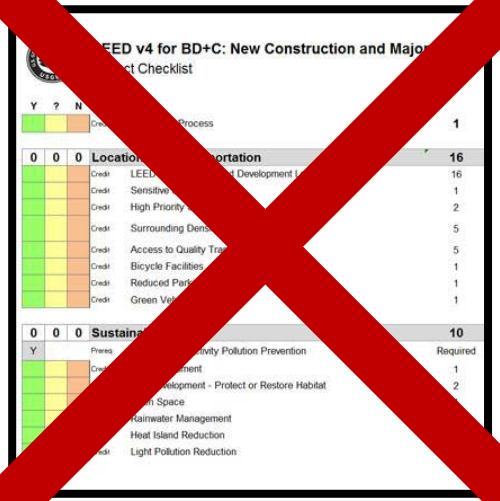
DECEMBER 18, 2017

Perkins Eastman | DPC

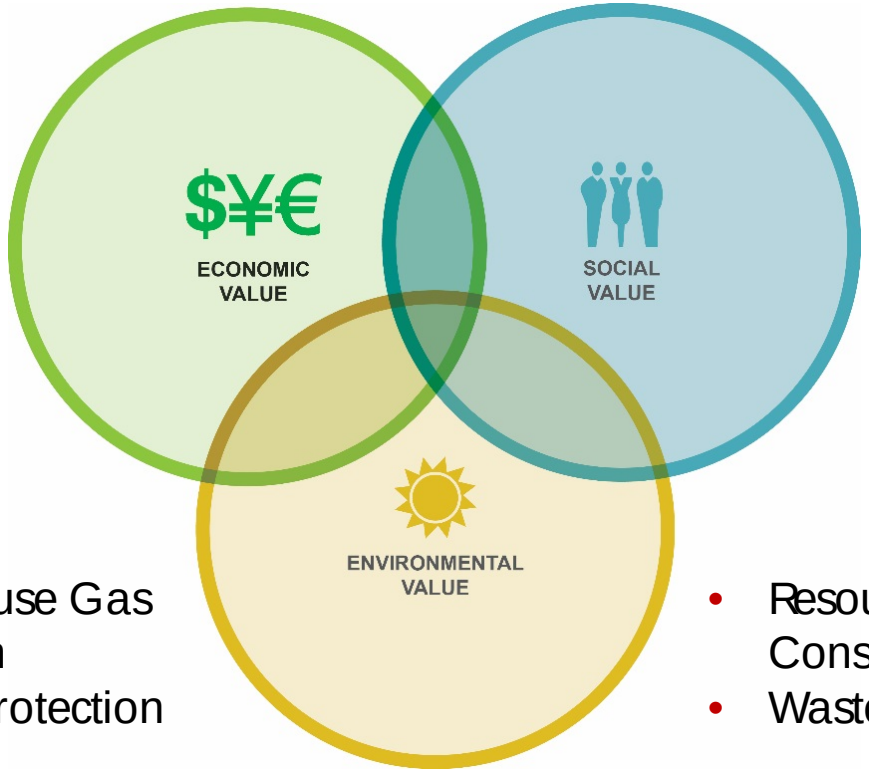
- DEFINING SUSTAINABILITY
- BENCHMARKING
- SUSTAINABILITY WORKSHOP OUTCOMES

DEFINING SUSTAINABILITY

WHAT IS SUSTAINABILITY?



- First Costs
- Operating Costs
- ROI



- Health & Wellness
- Social Justice
- Education

- Greenhouse Gas Reduction
- Habitat Protection

- Resource Conservation
- Waste Reduction

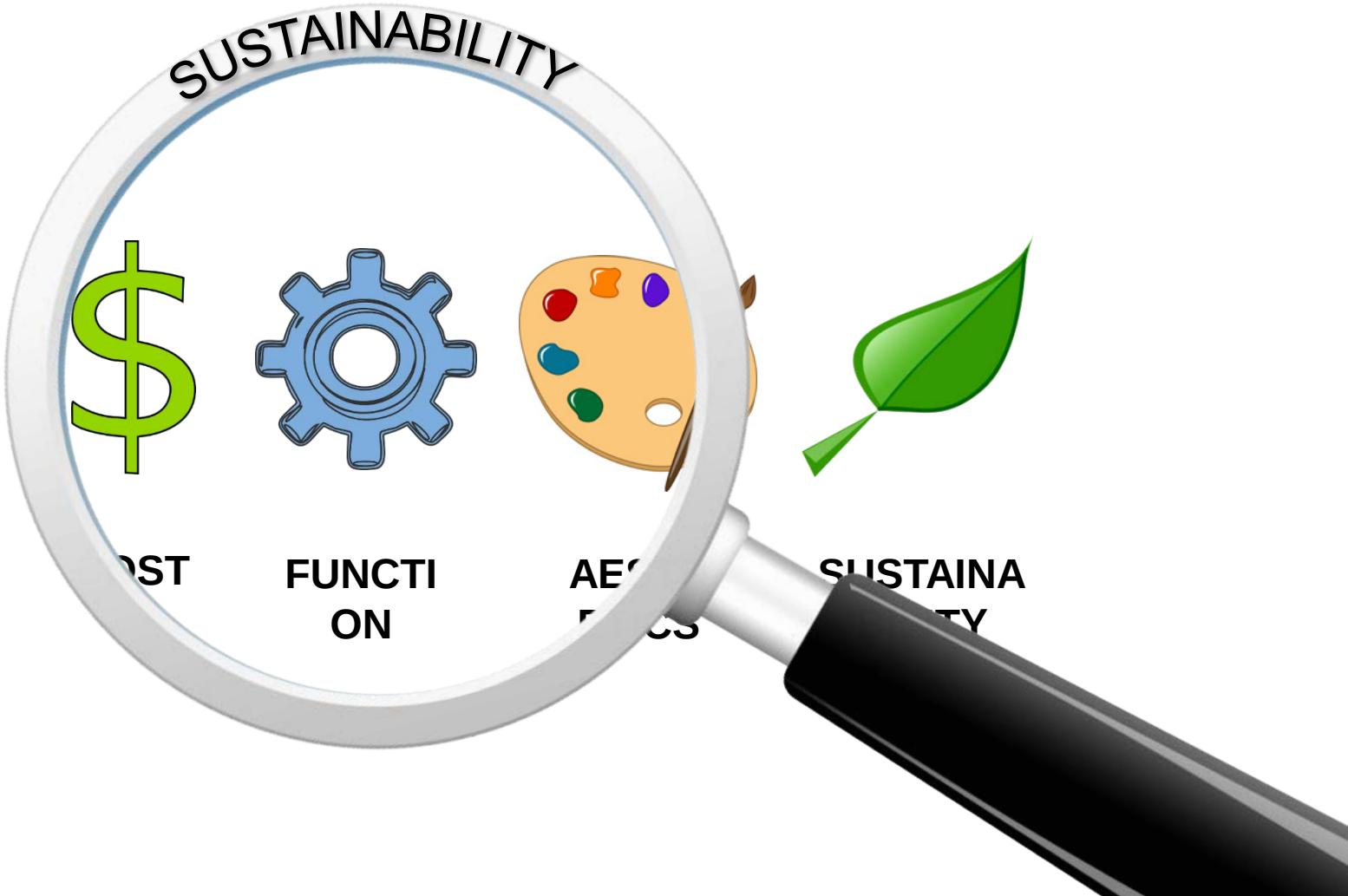
SUSTAINABILITY IS EVERYTHING

SUSTAINABILITY =

CREATING **AS MUCH VALUE AS POSSIBLE**

(SOCIAL, ECONOMIC, ENVIRONMENTAL)

BY HAVING **A MEASURABLY POSITIVE IMPACT.**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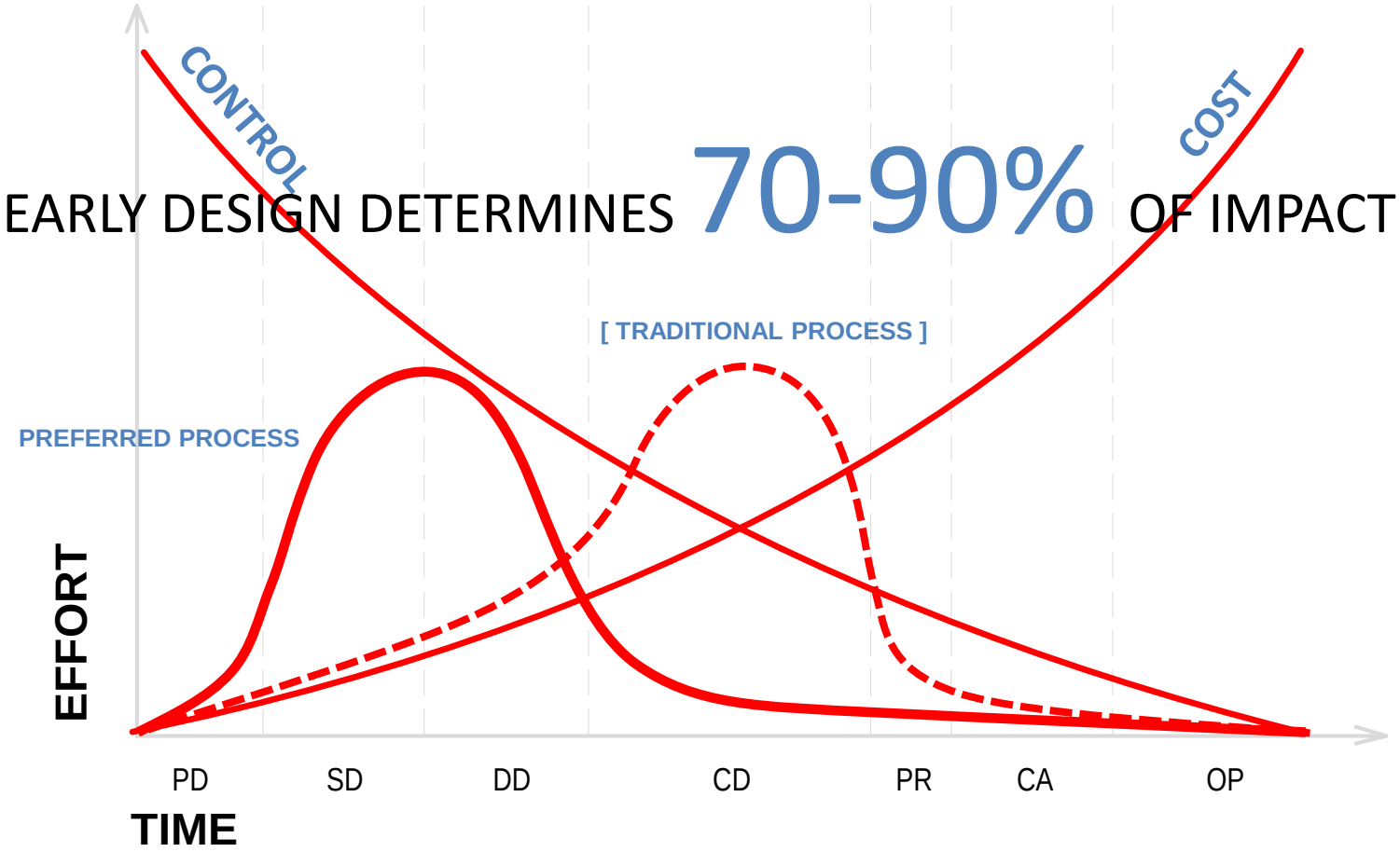
INTEGRATIVE PROCESS

EARLY DESIGN DETERMINES 70-90% OF IMPACT



THIRD-PARTY CERTIFICATION

LEED V4 VS 2009

- Location and Transportation
- Sustainable Sites
- Water Efficiency
- Energy & Atmosphere
- Material & Resources
- Indoor Environmental Quality
- Integrative Process
- Innovation

BENCHMARKING

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DUNBAR

- Washington, DC
- New Construction
- 280,000 sf / 4 Floors
- 47% energy savings
  - EUI – 44 kBtu/sf/yr
- 50% indoor water use reduction
- Geothermal, Photovoltaics

Highest Scoring LEED for Schools v3 Project in the world.

MLK

- Cambridge, MA
- New Construction
- 168,000 sf / 3 Floors
- 70% energy savings
  - EUI - 28 kBtu/sf/yr
- +40% indoor water use reduction
- 85% of classrooms daylight autonomous
- Geothermal, Photovoltaics
- Building as a Teaching Tool

SUSTAINABILITY WORKSHOP OUTCOMES

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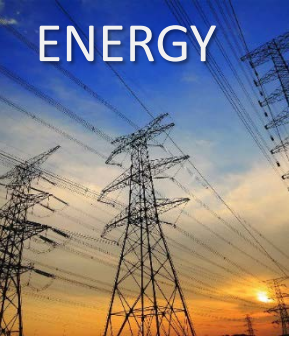
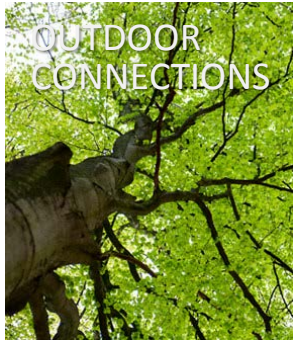


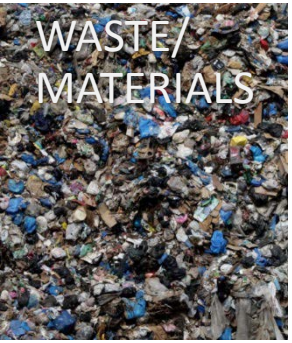
- Reduce Need
- Improve Operations
- Generate On-Site

- Daylight
- Thermal Comfort
- Acoustics
- Air Quality & Material Health

- Reduce Usage
- Incorporate Reuse
- Manage Stormwater



- Outdoor Classrooms
- Bring the Outdoors In
- Open-up Façade

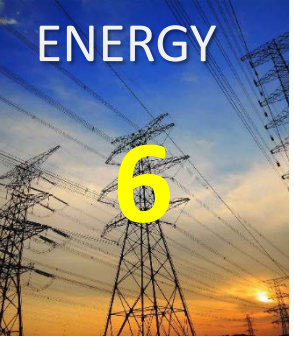


- Reduce use of disposables
- Divert from landfill – Recycle & Compost
- Reuse of Existing Materials

- After-hours Use by Community
- Learning Resources for Parents
- Equity & Help Those in Need

- Relationship to Resources
- How Systems Work
- How Things Are Made

- Healthy Food Choices
- Playgrounds & Fitness
- Encourage Active Lifestyle



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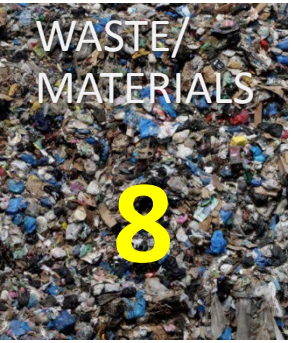

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MEP WORKSHOP OUTCOMES

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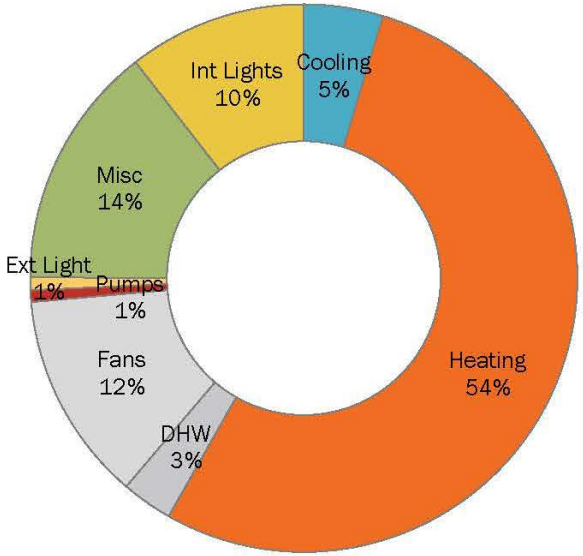
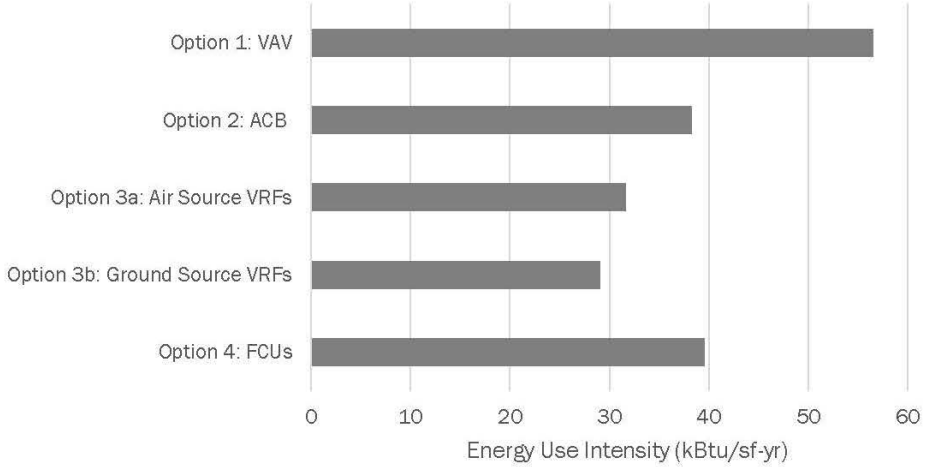
ENERGY USE COMPARISON

ENERGY USE BREAKDOWN: BASELINE VAV

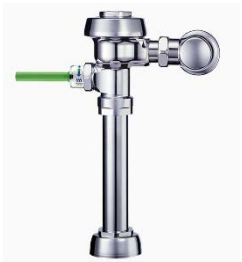


ENERGY USE INTENSITY



WATER CONSERVATION & PLUMBING

- WATERLESS URINAL



- DUAL FLUSH TOILETS

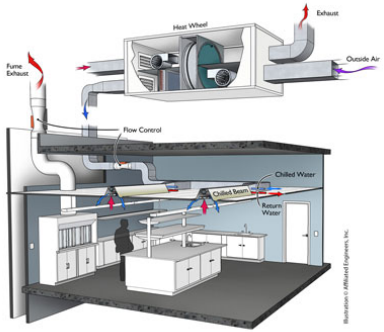
- RAINWATER COLLECTION

SMALL SYSTEM – 5000 GALLON TANK FOR CAPTURED RAINWATER FROM ROOF TO WATER EDUCATIONAL GARDENS

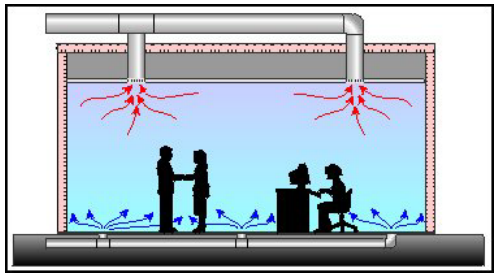
- HARDWIRED – SENSOR FAUCETS

- SINK AT GANG TOILETS

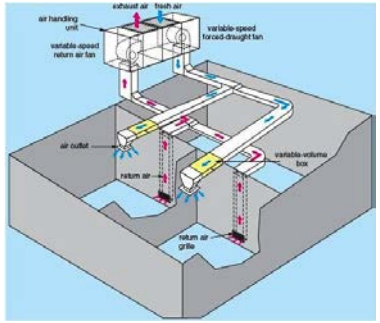
MECHANICAL SYSTEMS



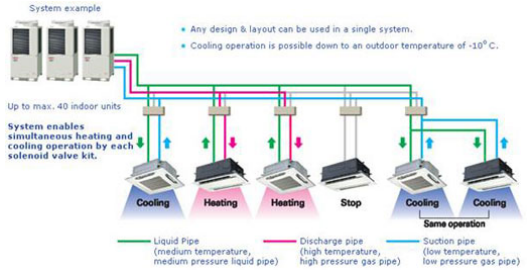
- CHILLED BEAM



- DISPLACEMENT VENTILATION



- VARIABLE AIR VOLUME (VAV)



- VARIABLE REFRIGERANT FLOW (VRF)

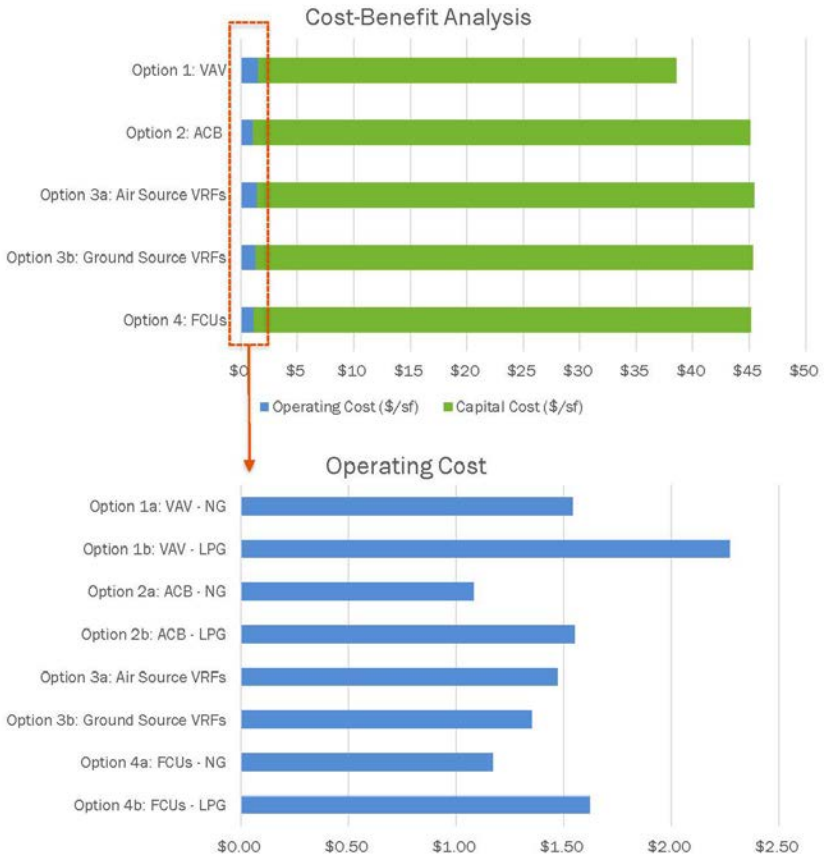
CRITERIA

- LOW MAINTENANCE
- ENERGY CONSERVATION
- SOUND PROFILE

BASE SYSTEM

- CHILLED BEAMS AT CLASSROOM WINGS
- VRF AT OFFICES AND YEAR ROUND OCCUPIED SPACES

SYSTEM COST ANALYSIS



FUEL SOURCE – FIRST COST

- PROPANE

  ASSUMPTION – 36X30 CONCRETE PAD, 8” THICK WITH 6” CRUSHED STONE, BURIED 4’-0” BELOW GRADE, (6) 1000 GALLON TANKS, 75’ OF STAINLESS STEEL CORREGATED PIPE IN BLACK IRON SLEEVE

  APPROX. ESTIMATED COST - $207,480

- NATURAL GAS

  ASSUMPTION – 5300’ OF (4”) NATURAL GAS PIPING, EXCAVATE AND BACKFILL TO 4’-0” BELOW GRADE, PLACED ADJACENT TO THE ROAD FOR 4700’ AND IN THE ROAD FOR 600’ AT THE ROUTE 1 APPROACH, CARRY 50k FOR BOULDER AND ROCK REMOVALS AND UNFORSEEN CONDITIONS

  APPROX ESTIMATED COST - $655,594

- GEO-THERMAL

  110 CLOSED LOOP WELLS AT A DEPTH OF 600 FEET EACH, (13) HEAT PUMPS, ALLOWANCE OF 30k FOR PUMPS AND ASSOCIATED PIPING ON THE FIELD SIDE

  APPROX ESTIMATED COST - $2,875,565

GAS USE PROFILES

		First Costs	Maintenance Cost Annual Recurring	
			First 12 years	Next 12 years
Opt 1	Chilled Beam / VRF with Geo-thermal	$ 2,875,656	$ 24,000	$ 32,000
Opt 2	Chilled Beam / VRF with LPG	$ 171,480	$ 36,000	$ 48,000
Opt 3	Chilled Beam / VRF with Nat. Gas	$ 655,594	$ 30,000	$ 40,000

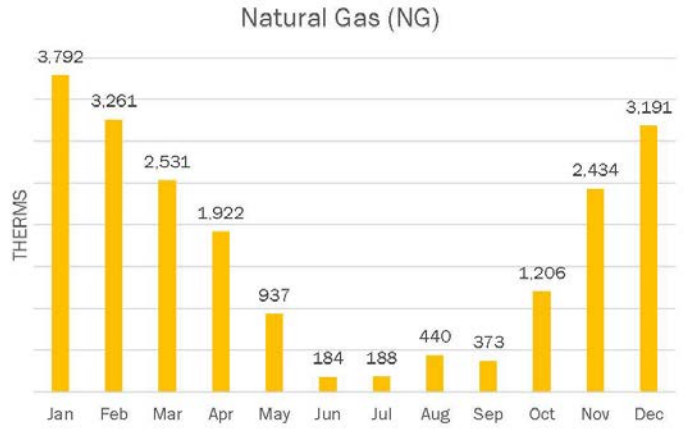
Electric	16 cents/KWH
NG (1030 BTU per CF)	$1.05/Therm (+/- 100 CF or 1.2 gallon)
LPG (2488 BTU per CF)	$1.6/Gallon

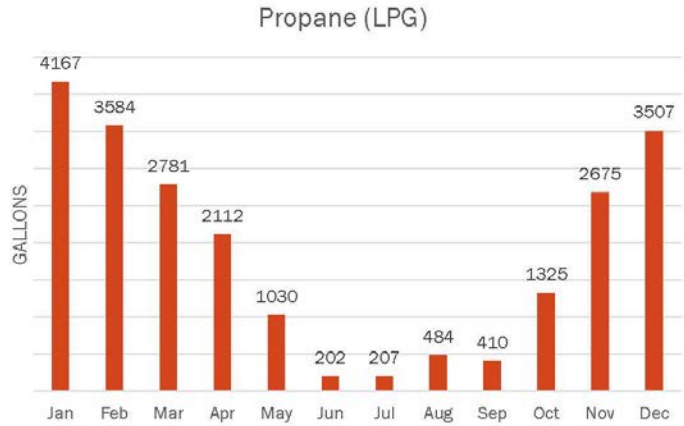
	Lbs of Co2 Emissions
NG	769,802
LPG	789,108
Geo	549,173

Assumptions:

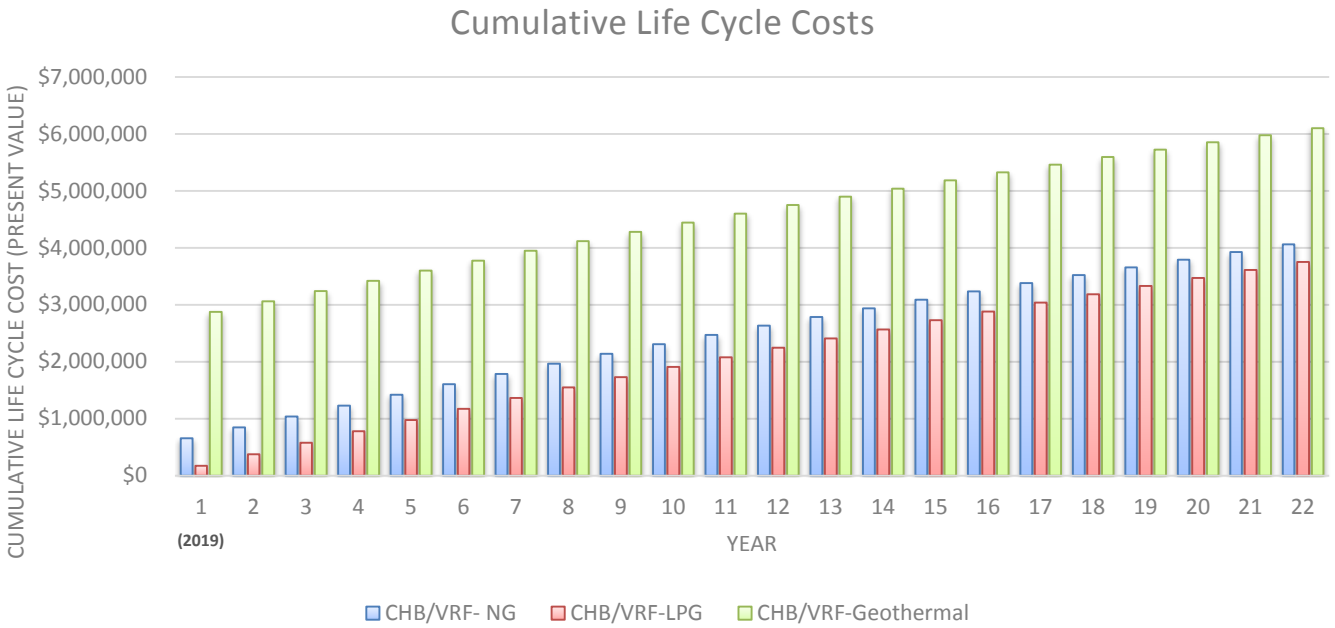
- Discount rate: 3% (from FEMP FY 2015)
- Study period: 22 years
  Note: Price escalation & discount rates are valid for 25 years from now. Year 1 in the chart is 2019.
- Price escalation rate: DOE escalation rates (variable by each year) as published for New England census region

GAS USE PROFILES





LCCA RESULTS



Results:

- Geothermal has the highest life cycle cost (not savings)
- LPG option has the lowest life cycle cost.
  Note: LPG rates are volatile. Life Cycle Costs for LPG may trend differently than shown in the chart depending on how future LPG rates escalate. Towards the end of the LCCA time period, these two options seem to be getting closer to each other.